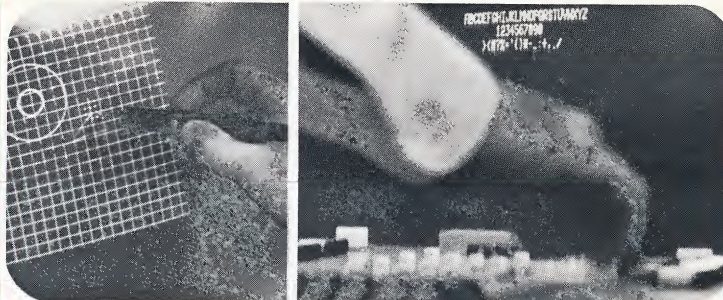




MODEL 8190 Graphics Terminal



*\$20K
incl. Vectors,
chr. gen.,
table*

*+
ca.
5-10
interface*

The MONITOR DISPLAY 8190 generates and displays characters and graphics from digital input data. The basic terminal contains a CRT monitor, position, character, and vector generators, packaged in an attractive user oriented console.

Options are available for expansion of the 8190 up to a full interactive graphics system such as The Monitor Displays Model 8100. These options may be installed prior to delivery or when

needed.

This economical terminal will write characters at the rate of 10 microseconds maximum per character or faster as an option and graphics at the rate of 200,000 inches per second. Random positioning time is 14 microseconds for full scale deflection. Character-to-character positioning time is 3 microseconds.

DESIGN FEATURES

- Performs all generation and display functions of a graphic system
- Simple interface to display controller
- Expandable by incremental options to full interactive graphics system
- Proportional time vectors with constant intensity output
- High resolution arcs (option)
- 4-programmable character sizes
- Programmable character orientation-horizontal or vertical
- Repertoire of 64 alphanumeric characters and symbols
- Large Display Area (12" x 12")
- Phosphor protection
- Pincushion correction

FUNCTIONAL DESCRIPTION

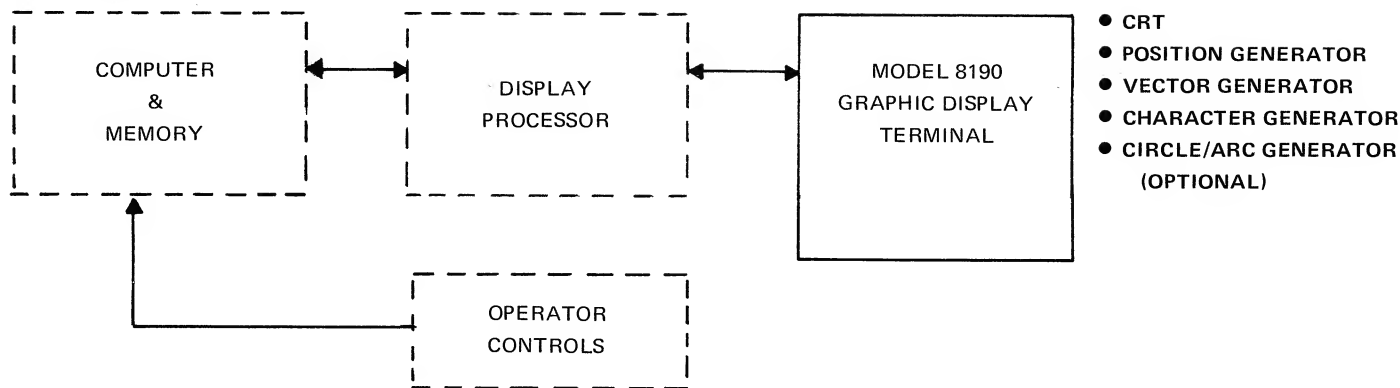


FIGURE 1-TYPICAL INTERACTIVE GRAPHIC DISPLAY SYSTEM

The use of a Model 8190 Graphics Display Terminal is shown in figure 1. Data contained in an external computer is applied to a display processor where it is formatted for input to the 8190 terminal.

An operator control panel interfaces with the computer to provide the desired interaction. Devices typically contained on this panel are special function keys, light pens, trackballs or graphic tablets.

The 8190 terminal provides a digital to analog interface as well as the analog circuits and function generators necessary to display computer generated data on a cathode ray tube. The system approach shown in Figure 1 allows the user to concentrate on the computer and software aspects of the system and to treat the display hardware as a black box.

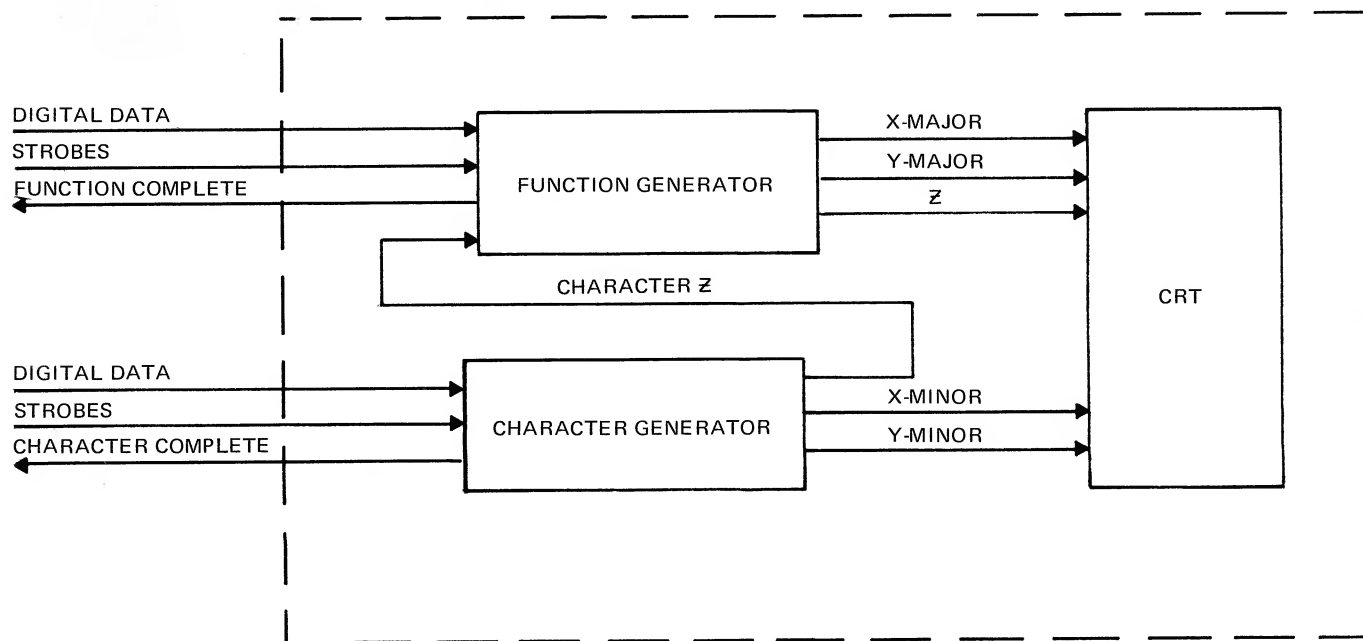


FIGURE 2 BLOCK DIAGRAM, MODEL 8190 GRAPHIC DISPLAY TERMINAL

A block diagram of the 8190 is shown in Figure 2. The function generator contains the position generator and vector generator. A circle/arc generator can be added as an option. The function generator accepts digital inputs from an external source and derives the necessary deflection and intensity signals to drive the CRT display. After the specified graphic element is drawn, a function complete signal is supplied to the external data source.

Character identification data is strobed into the character gen-

erator, which contains all circuitry necessary to supply the minor deflection signals to the CRT. A character intensification signal is applied to the intensity select circuitry in the function generator. After the character is drawn on the CRT, a character complete signal is supplied to the external data source.

The CRT is a 21" rectangular display representing the output device of the computer display system.

SPECIFICATIONS

OVERALL PHYSICAL CHARACTERISTICS (with all chassis mounted)

- a. Size 62"W x 49"H x 30"D
- b. Weight approximately 500 lbs.
- c. Power 115v $\pm$ 10%, 60 Hz $\pm$ 5%,
single phase, 5A
- d. Temperature Range 50°F to 100°F
- e. Humidity To 95% without
condensation

CHARACTER GENERATOR

All digital input and output signal levels and impedances are compatible with conventional TTL integrated-circuit logic.

Inputs

- (a) Character Address: 6-bit parallel word selects 1 of 64 characters. Lines are high when true. Lines must not change while character is being drawn.
- (b) Character Reset: Negative-going pulse used to reset digital-to-analog converter. Pulse width should be 100 nanoseconds minimum. Must precede the character strobe.
- (c) Character Strobe: Negative-going pulse used to synchronize internal clock. Generation starts on the first internal clock edge after the leading edge of strobe. Pulse width should be greater than one stroke period but less than 2 stroke periods.
- (d) Character Orientation: A high level on this line causes the character to be drawn in a horizontal orientation. This signal should not change during the time a char-

acter is being drawn. 100 nanoseconds are required for the orientation circuitry to settle to the new value.

(e) Character Size:

Two signal lines that are used to select 1 of 4 character sizes. Four microseconds are required for the size select circuitry to settle.

Outputs

- (a) Character Complete: Negative-going pulse 500 nanoseconds wide. Leading edge indicates that character is complete.
- (b) Character Deflection Voltages: $\pm$ 1.5 volts @ 20 mA (measured at the input to any display when terminated with 75 OHMS.)
- (c) Character Intensification Voltage: Digital signal TTL compatible, low during blanking, high during writing.

FUNCTION GENERATOR

Contains position and vector generators (circle/arc generators optional)

Inputs

- (a) Data Bus (Standard) 15 bit parallel word. Lines are high when true. Word contains the x and y position, circle radius, arc starting position, arc ending position, vector x and y projection, or x and y projection of a short vector. Routed into appropriate generator by 1 of 8 strobes.
- (b) X Position Strobe (Option P) Negative going pulse used to enter x position coordinate into D/A converter. Zero x coordinate is located at the left of the CRT.

(c) Y Position Strobe (Option P)

Negative going pulse used to enter y position coordinate into D/A converter. Zero y coordinate is located at the top of the CRT.

(d) Circle Radius Strobe (Option C)

Negative going pulse used to enter circle radius information into circle generator.

(e) Arc Start Strobe (Option CA)

Negative going pulse used to enter arc starting location into arc generator. Zero degree position of arc is defined along the minus x axis. Circle can be considered to be composed of 1024 arc segments.

(f) Arc End Strobe (Option CA)	Negative going pulse used to enter arc ending location into arc generator.	(j) Line Structure (Option PL)	Two data lines used to define the line structure of any vector. Solid, dotted, dashed, or dot-dashed lines may be drawn.
(g) Δx Strobe (Standard)	Negative going pulse used to enter signed Δx data into vector generator. Minus Δx causes the vector to be drawn toward the lefthand edge of the CRT. Plus Δx causes the vector to be drawn toward the righthand edge of the CRT.	(k) Intensity Level (Option P)	Two data lines used to define 1 of 4 intensity levels (including blank) at which graphic element will be drawn.
(h) Δy Strobe (Standard)	Negative going pulse used to enter signed Δy data into the vector generator. Minus Δy causes the vector to be drawn toward the bottom of the CRT. Plus Δy causes the vector to be drawn toward the top of the CRT.	Outputs	
(i) Short Vector Strobe (Standard)	Negative going pulse used to enter both the signed Δx and signed Δy data into the vector generator. Short vector resolution is limited to ± 6 bits (± 64 raster elements).	(a) Circle/Arc Complete	Negative going pulse indicating that circle or arc has been drawn.
		(b) Vector Complete	Negative going pulse indicating that vector has been drawn.
		(c) X-Deflection	± 3 volts into a 75 ohm load
		(d) Y-Deflection	± 3 volts into a 75 ohm load
		(e) Intensity	Standard unit provides a TTL output level.

CRT DISPLAY

CATHODE-RAY TUBE

SIZE AND TYPE	21" with P31 phosphor and bonded faceplate.
DISPLAY AREA	12" x 12"
LINEARITY	$\pm 1\%$
PINCUSHIONING	$\pm 2\%$
LIGHT OUTPUT	50 foot-lamberts
WRITING SPEED	500,000 inches/second
SPOT SIZE	0.020"

Z-AXIS

INPUT SENSITIVITY	+3 v for full intensity
INPUT IMPEDANCE	75-ohm termination is standard.
RISE TIME	50 nsec
GAMMA CORRECTION ...	Light output is linear with respect to input voltage
DELAY TIME	Zero differential delay of the z-axis with respect to the X and Y signals.

MAJOR DEFLECTION

INPUT SENSITIVITY	5 v p-p for 12" deflection.
INPUT IMPEDANCE	75-ohm termination is standard.
LARGE SIGNAL RESPONSE	20 kHz.
SMALL SIGNAL RESPONSE	500 kHz @ -3db.
X-Y PHASE SHIFT	Less than 1 line separation @ 15 kHz.
SETTLING TIME	14 microseconds for full deflection within 12" x 12" viewing area to settle within 0.25% .3 microseconds for 0.5" deflection to settle within 0.25%

MINOR DEFLECTION

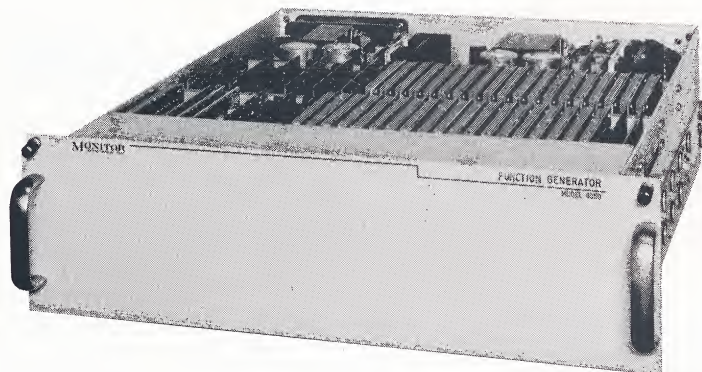
INPUT SENSITIVITY	5 v p-p 0.5 inch deflection.
INPUT IMPEDANCE	75-ohm termination is standard
FREQUENCY RESPONSE	1 MHz @ -3db.
X-Y DIFFERENTIAL PHASE SHIFT	Less than 1 line separation @ 1 MHz.

8190 4-70 10M

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MODEL 8050 FUNCTION GENERATOR FOR GRAPHIC DISPLAY SYSTEMS

The MONITOR Model 8050 is a function generator for computer graphics applications. It generates vectors, circles, and arcs for a CRT display. The modular design permits the selection of a number of functions to meet the exact requirements of your graphics system.

DESIGN FEATURES

- Well Defined Interfaces
- Asynchronous operation—writing time is a function of the graphic element being drawn
- Constant intensity vectors
- Circle intensity compensation
- High resolution arcs
- 4 lines structures available
- Built-in expandability

SPECIFICATIONS

All digital input and output signal levels and impedances are compatible with conventional TTL integrated-circuit logic. All strobe pulses and "complete" signals are nominally 500 nanoseconds wide.

Inputs

a) Data Bus (Standard)

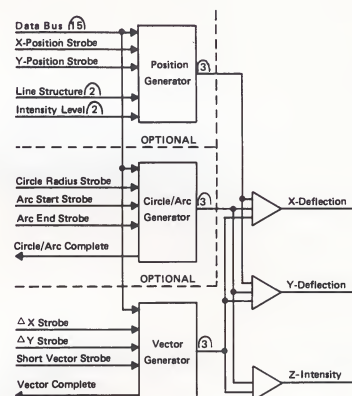
15 bit parallel word. Lines are high when true. Word contains the x and y position, circle radius, arc starting position, arc ending position, vector x and y projections, or both the x and y projection of a short vector. Routed into appropriate generator by 1 of 8 strobes.

(b) X Position Strobe (Option P)

Negative going pulse used to enter x position coordinate into D/A converter. Zero x coordinate is located at the left of the CRT.

(c) Y Position Strobe (Option P)

Negative going pulse used to enter y position coordinate into D/A converter. Zero y coordinate is located at the top of the CRT.



FUNCTIONAL DESCRIPTION

Data from an external source is applied to the input of a position generator, circle/arc generator and a vector generator. The data will be accepted by the appropriate generator by the activation of 1 of 8 strobes. Upon completion of the graphic function, a circle/arc or vector complete signal is sent back to the external source. The three generators develop the deflection signals necessary to position the beam of a cathode-ray tube and to cause a vector, arc or circle to be drawn. Additional outputs from the vector and circle/arc generator are summed and applied to the intensity input of the CRT.

SPECIFICATIONS (cont.)

(d) Circle Radius Strobe (Option C)	Negative going pulse used to enter circle radius information into circle generator.
(e) Arc Start Strobe (Option CA)	Negative going pulse used to enter arc starting location into arc generator. Zero degree position of arc is defined along the minus x axis. Circle can be considered to be composed of 1024 arc segments.
(f) Arc End Strobe (Option CA)	Negative going pulse used to enter arc ending location into arc generator.
(g) Δx Strobe (Standard)	Negative going pulse used to enter signed Δx data into vector generator. Minus Δx causes the vector to be drawn toward the lefthand edge of the CRT. Plus Δx causes the vector to be drawn toward the righthand edge of the CRT.
(h) Δy Strobe (Standard)	Negative going pulse used to enter signed Δy data into the vector generator. Minus Δy causes the vector to be drawn toward the bottom of the CRT. Plus Δy causes the vector to be drawn toward the top of the CRT.
(i) Short Vector Strobe (Standard)	Negative going pulse used to enter both the signed Δx and signed Δy data into the vector generator. Short vector resolution is limited to ± 6 bits (± 64 raster elements).
(j) Line Structure (Option PL)	Two data lines used to define the line structure of any vector. Solid, dotted, dashed, or dot-dashed lines may be drawn.
(k) Intensity Level (Option P)	Two data lines used to define 1 of 4 intensity levels (including blank) at which graphic element will be drawn.

Outputs

(a) Circle/Arc Complete	Negative going pulse indicating that circle or arc has been drawn.
(b) Vector Complete	Negative going pulse indicating that vector has been drawn.
(c) X-Deflection	± 3 volts into a 75 ohm load
(d) Y-Deflection	± 3 volts into a 75 ohm load
(e) Intensity	Standard unit provides a TTL output level. One of four optional analog voltage levels may be selected.

Vector Generator Characteristics

(a) Writing Rate	5 microseconds plus 5 microseconds per inch.
(b) Linearity	$\pm 1\%$ of full scale
(c) Resolution	10 bits plus sign for both the x and y components.
(d) Delay	Less than 100 nanoseconds delay between x or y and intensity output.
(e) Intensity Rise & Fall Time	Less than 50 nanoseconds.

8050 4-70 10M

Circle/Arc Generator Characteristics

(a) Writing Rate	All circles require 300 microseconds. Arcs require 300-400 microseconds depending on starting and ending coordinates. Intensity signal is unblanked for the last 75 microseconds of the total drawing time.
(b) Linearity	$\pm 1\%$ of full scale.
(c) Resolution	10 bits each for radius, arc starting coordinate and arc ending coordinate.
(d) Phase Shift	Phase shift between the x and y deflection signals is less than 1 degree.
(e) Intensity Compensation	All circles larger than one inch in diameter have their intensity output signal level compensated as a function of the circle radius.
(f) Direction	Circle is drawn clockwise with its starting location positioned along the minus x axis.

Position Generator Characteristics

(a) Positioning Linearity	$\pm 0.2\%$ of full scale
(b) Resolution	10 bits each in x and y

Power Requirements

(a) Input Power	115v $\pm 10\%$, 60 Hz $\pm 5\%$, single phase @ 1A (total for all options)
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Mechanical Configuration

(a) Size Total for 8050 with circle and arc options	19" W x 5-7/32"H x 20-7/8"D
Total for 8050 and circle, arc, and position options.	19" W x 5-7/32"H x 26-1/2"D
(b) Weight	65 lbs. or 86 lbs. depending upon options.

Environment

(a) Temperature	50°F to 100°F
(b) Relative Humidity	to 95% without condensation. Other ranges available on special order.

Ordering

8050 is the designation for the basic model vector generator. These options are available:

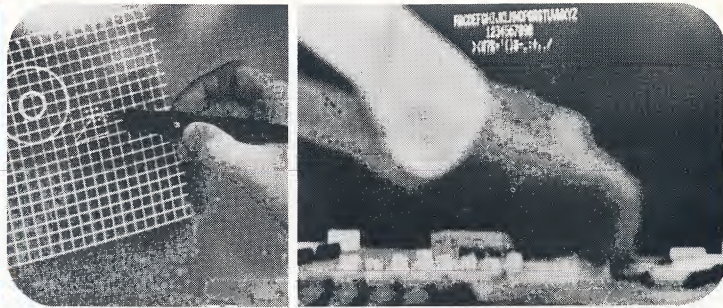
- C — Circle Generator
- A — Arc Generator
- P — Position Generator
- L — Line Structure (Dash, Dot, Dash-Dot)

When ordering, add option codes to basic model number. For example, 8050CP for function generator with Vector, Circle and Position generators.

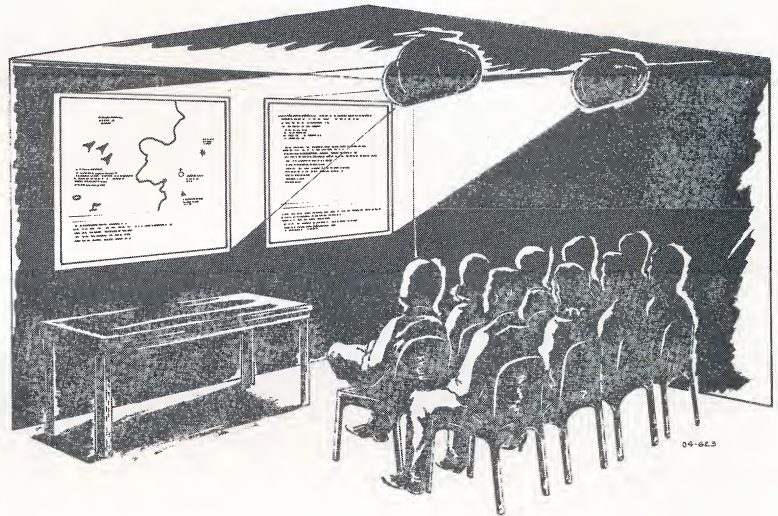
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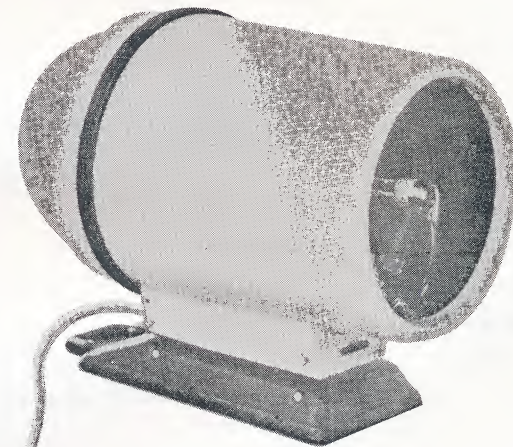
MODEL 8060 PROJECTION DISPLAY FOR COMPUTER GRAPHIC TERMINALS SYSTEMS



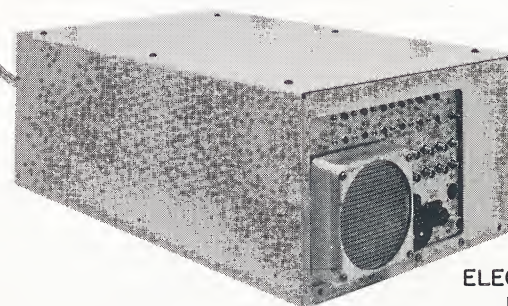
The MONITOR Model 8060 Projection Display is a direct-writing, alphanumeric/graphic computer output display. Characters, dots, vectors, or conics may be displayed. Gamma correction and delay time cancellation are provided so that special circuits are not required in the appropriate generators. The tube is protected from phosphor burns as a result of failure in the deflection circuitry or absence of input signal. Up to 1000 characters may be displayed at a refresh rate of 60 Hz; the writing rate for vectors and graphics is 1,000,000 inches/second. A complete line of character, vector, circle, and arc generators is available from MONITOR to work with this unit. Projection is accomplished thru a Schmidt optical system. The projection head is separate from the display electronics thus allowing optimum positioning of the projection head.

DESIGN FEATURES

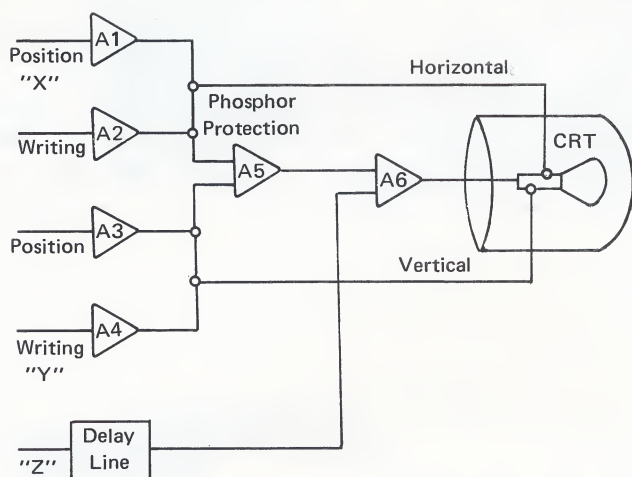
- Single Magnetic Coil Deflection
- All Silicon Solid State Circuitry
- Large Display Area (48" x 48")
- Zero differential delay interface for faithful reproduction of characters, vectors, and conics.
- Gamma Correction
- Phosphor Protection
- Low Power Consumption
- Separate Projection Head



PROJECTION
HEAD



ELECTRONICS
UNIT



A1 through A4 are wideband amplifiers used for positioning and writing. All amplifiers are DC coupled and have 75-ohm inputs. Self-contained adjustments are available to set up each channel. A5 is the phosphor protection amplifier whose output inhibits the z-axis amplifier, A6, should there be no deflection signal at the outputs of A1-A4. A6 is the z-axis amplifier with gamma correction which is DC coupled and accepts an analog signal. A delay line is added in series with the input to match the delay of the x and y amplifiers.

SPECIFICATIONS

Projection Head

Size and type	14" Schmidt Optics
Throw Distance	13' - 18'
Display Area	48" X 48"
Linearity	±1%
Light Output	5 foot-lamberts at 13 feet
Writing Speed	1,000,000 inches/second
Line Width	0.100"

Frequency Response	1 MHz @ 3db
X-Y Differential Phase Shift	Less than 1 line separation @ 1 MHz

Inputs (BNC Connectors, rear)

1. X-Input Major Deflection
2. X-Input Minor Deflection
3. Y-Input Major Deflection
4. Y-Input Minor Deflection
5. Z-Input

Operator Controls

- On/Off
- Focus
- Intensity

Service Adjustments: (Rear)

- X-Input deflection sensitivity
- X-Input D.C. level
- Y-Input deflection sensitivity
- Y-Input D.C. level
- Z-Input D.C. level

Power Requirements	115V ±10% 60 Hz, 300 watts
Environment	50°F to 100°F
Size	Electronics Unit 9"H x 14 1/4"W x 28 1/2"D Projection Head 20"H x 16"W x 30"D
Weight	Electronics Unit - 75 pounds Projection Head - 35 pounds

Other Options

- Higher performance
- Custom configuration
- Daisy chain operation
- Ruggedized units
- MIL or NASA Specifications

Z-Axis

Input Sensitivity	+3v for full intensity
Input Impedance	75-ohm termination is standard.
Rise Time	50 nsec.
Gamma Correction	Light output is linear with respect to input voltage.
Delay Time	Zero differential delay of the z-axis with respect to the X and Y signals.

Major Deflection

Input Sensitivity	5 vpp for 48" deflection
Input Impedance	75-ohm termination is standard
Large Signal Response	20 KHz
Small Signal Response	500 KHz @ -3db
X-Y Phase Shift	Less than 1 line separation at 15 KHz
Settling Time	25 microseconds for full screen deflection to settle to within 0.25%. 3 microseconds for 1.0 inch to settle to within 0.25%.

Minor Deflection

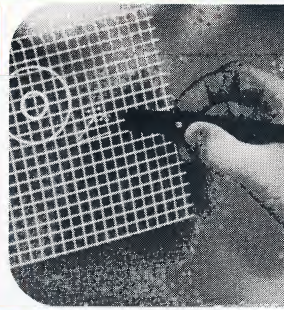
Input Sensitivity	5vpp for 2 inch deflection
Input Impedance	75 ohm (termination)

8060 4-70 10M

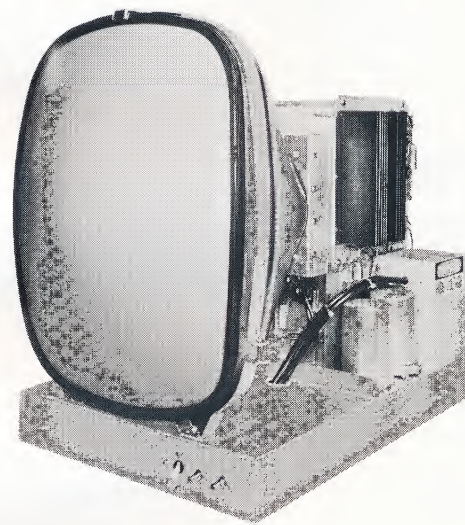
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MODEL 8011 CRT GRAPHICS MONITOR for COMPUTER GRAPHIC TERMINALS

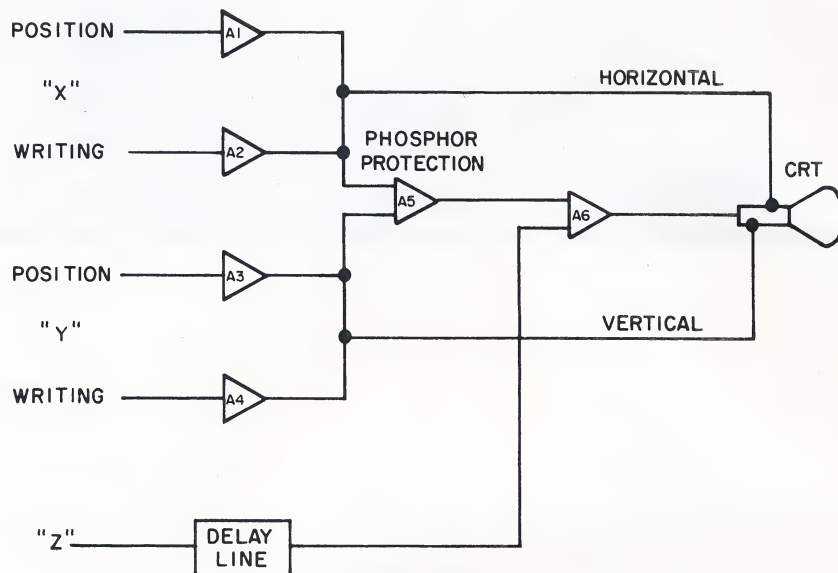


The MONITOR Model 8011 CRT GRAPHICS MONITOR is a direct-writing, alphanumeric/graphic computer output display. Characters, dots, vectors or conics may be displayed. Gamma correction and delay time cancellation are provided so that special circuits are not required in the appropriate generators. The tube is protected from phosphor burns as a result of failure in the

deflection circuitry or absence of input signal. Up to 1000 characters may be displayed at a refresh rate of 60 Hz; the writing rate for vectors and graphics is 500,000 inches/second. A complete line of character, vector, circle, ellipse and arc generators is available from MONITOR to work with this unit.

DESIGN FEATURES

- SINGLE MAGNETIC COIL DEFLECTION
- ALL SILICON SOLID STATE CIRCUITRY
- LARGE DISPLAY AREA (12" x 12")
- ZERO DIFFERENTIAL DELAY INTERFACE FOR FAITHFUL REPRODUCTION OF CHARACTERS, VECTORS, AND CONICS.
- BONDED FACEPLATE
- GAMMA CORRECTION
- PHOSPHOR PROTECTION
- PINCUSHION CORRECTION
- LOW POWER CONSUMPTION



A1 through A4 are wideband amplifiers used for positioning and writing. All amplifiers are dc coupled and have 75-ohm inputs. Self-contained adjustments are available to set up each channel. A5 is the phosphor protection amplifier whose output inhibits the z-axis amplifier, A6, should there be no deflection signal at the outputs of A1 – A4. A6 is the z-axis amplifier with gamma correction which is dc coupled and accepts an analog signal. A delay line is added in series with the input to match the delay of the x and y amplifiers.

SPECIFICATIONS

CATHODE-RAY TUBE

SIZE AND TYPE	21" with P31 phosphor and bonded faceplate.
DISPLAY AREA	12" x 12"
LINEARITY	±1%
PINCUSHIONING	±2%
LIGHT OUTPUT	50 foot-lamberts
WRITING SPEED	500,000 inches/second
SPOT SIZE	0.020"

Z-AXIS

INPUT SENSITIVITY	+3 v for full intensity
INPUT IMPEDANCE	75-ohm termination is standard.
RISE TIME	50 nsec
GAMMA CORRECTION	Light output is linear with respect to input voltage
DELAY TIME	Zero differential delay of the z-axis with respect to the X and Y signals.

MAJOR DEFLECTION

INPUT SENSITIVITY	5 v p-p for 12" deflection.
INPUT IMPEDANCE	75-ohm termination is standard.
LARGE SIGNAL RESPONSE	20 kHz.
SMALL SIGNAL RESPONSE	500 kHz @ -3db.
X-Y PHASE SHIFT	Less than 1 line separation @ 15 kHz.
SETTLING TIME	14 microseconds for full deflection within 12" x 12" viewing area to settle within 0.25% 3 microseconds for 0.5" deflection to settle within 0.25%

MINOR DEFLECTION

INPUT SENSITIVITY	5 v p-p for 0.5 inch deflection.
INPUT IMPEDANCE	75-ohm termination is standard
FREQUENCY RESPONSE	1 MHz @ -3db.
X-Y DIFFERENTIAL PHASE SHIFT	Less than 1 line separation @ 1 MHz.

INPUTS: (BNC Connectors, rear)

1. X-input Major Deflection
2. X-input Minor Deflection
3. Y-input Major Deflection
4. Y-input Minor Deflection
5. Z-input

OPERATOR CONTROLS: (Front)

- On/off
- Focus
- Intensity

SERVICE ADJUSTMENTS: (Rear).

- X-input deflection sensitivity
- X-input D.C. level
- Y-input deflection sensitivity
- Y-input D.C. level
- Z-axis D.C. level

POWER REQUIREMENTS	115 v ± 10%, 60 Hz, 300 watts
ENVIRONMENT	50° F to 100° F.
SIZE	24½" H x 19" W x 27½" D.

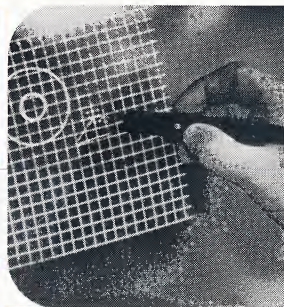
OPTIONS:

- RACK MOUNTABLE Includes Parts for mounting in 19" relay rack.
- COVER HOOD 20¾" H x 24" W x 33" D. CRT Horizontal.

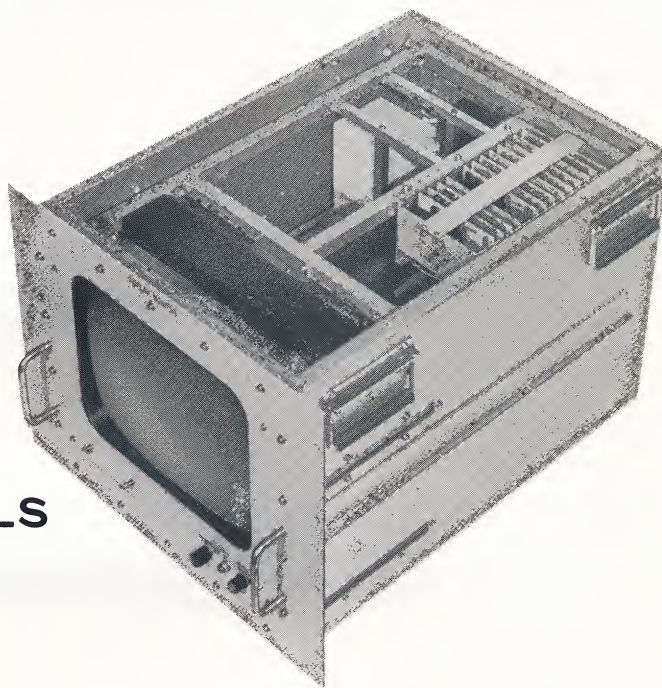
- OTHER OPTIONS
 - Higher performance
 - Custom configurations
 - Daisy chain operation.
 - Ruggedized units.
 - MIL or NASA Specifications

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MODEL 8012 RUGGEDIZED CRT DISPLAY FOR COMPUTER GRAPHIC TERMINALS



The MONITOR Model 8012 CRT Display is a direct-writing, alphanumeric/graphic computer output display. Characters, dots, vectors, circles, arcs or conics may be displayed. Gamma correction and delay time cancellation are provided so that special circuits are not required in the appropriate generators. The tube is protected from phosphor burns as a result of failure in the deflection circuitry or absence of input signal. Up to 1,000 characters may be displayed at a refresh rate of 60 Hz; the writing rate is 50,000 inches/second. A complete line of character, vector, circle, and arc generators are available from MONITOR to work with this unit. The unit is designed to meet the E.M.I. and environmental requirements of the military.

DESIGN FEATURES

- Single Magnetic Coil Deflection
- All Silicon Solid State Circuitry
- Large Display Area (8" x 10")
- Zero Differential Delay Interface for Faithful Reproduction of Characters, Vectors, and Conics.
- Gamma Correction
- Phosphor Protection
- Pincushion Correction
- Low Power Consumption
- Rack Mounting
- Ruggedized Unit

SPECIFICATIONS

Cathode Ray Tube

Size and Type	15" with P31 phosphor and shielded bonded faceplate
Display Area	8" x 10"
Linearity	±1%
Pincushioning	±2%
Light Output	50 foot-lamberts
Writing Speed	50,000 inches/second
Line Width	0.020"

Z-Axis

Input Sensitivity	+3V for full intensity
Input Impedance	75-ohm termination is standard

Rise Time	50 nsec
Gamma Correction	Light output is linear with respect to input voltage

Delay Time	Zero differential delay of the z-axis with respect to the X and Y signal
------------	--

Major Deflection

Input Sensitivity	5V for full scale deflection
Input Impedance	75-ohm termination is standard
Large Signal Response	15 kHz
Small Signal Response	500 kHz @-3db
X-Y Phase Shift	Less than 1 line separation @ 10 kHz
Settling Time	50 Microseconds to 0.25% for full screen deflection
	3 Microseconds to 0.25% for 0.5" deflection

Minor Deflection

Input Sensitivity	5V p-p for 0.5 inch deflection
Input Impedance	75-ohm termination is standard.
Frequency Response	1 MHz @-3db
X-Y Differential Phase Shift	Less than 1 line separation @ 1 MHz

Inputs: (BNC Connectors, rear)

1. Z-input Major Deflection
2. X-input Minor Deflection
3. Y-input Major Deflection
4. Y-input Minor Deflection
5. Z-input

Operator Controls: (Front)

On/Off
Focus
Intensity

Power Requirements	200V $\pm 10\%$ 3 phase 400 Hz / $\pm 5\%$, 300 watts
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Environment	0°C - 50°C operating temperature.
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Meets the shock and vibration requirements of MIL-STD-167

Size, basic chassis.	14-1/2"W x 12-7/8"H x 25"D
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Weight	70 lbs.
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Size with Front Panel & Mask	19"W x 14"H x 25"D
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Weight	75 lbs.
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Size with Front Panel & Mask and Case	19"W x 15-3/4"H x 25"D
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Weight	95 lbs.
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Available Options	8012P CRT with position generator
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8012-CP CRT with position generator and character deflection generator

OPTION P, POSITION GENERATOR FOR 8012 CRT

Functional Description

The input signal lines accept positioning address information and strobe it into two digital to analog converters which produce the x and y positioning voltages. These positioning

8012 4-70 10M

voltages are applied to the CRT deflection amplifiers. The position generator will display 512 addressable positions; 32 (x) positions and 16 (y) positions.

Specifications

Inputs:	Compatible with TTL logic levels (positive logic) x position - 5 bit parallel word y position - 4 bit parallel word position strobe pulse (negative transition)
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Settling Time	2 microseconds
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Accuracy	$\pm 0.5\%$ of full scale
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OPTION C, CHARACTER DEFLECTION GENERATOR FOR A 8012 CRT WITH OPTION P.

Functional Description

Input signal lines accept character stroke information and strobe it into storage registers. Each stroke of a character can be composed of the following:

x, 2x, sign (x), y, 2y, sign (y), z', z''

The output of the storage registers are converted to analog voltages by function generators. These voltage levels are summed and integrated by output drivers.

The length of an x or y stroke is 1/16".

The intensity levels are decoded and presented to the cathode of the CRT as intensity modulation voltages. One of four intensity levels (including blank) can be specified for each stroke of the character. The outputs of the character deflection drivers are summed with the positioning voltages in the CRT deflection amplifiers for the display of text information.

Specifications

Inputs	Compatible with TTL logic levels (positive logic) 8 bit parallel character stroke format
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x, 2x, sign (x)

y, 2y, sign (y)

z', z''

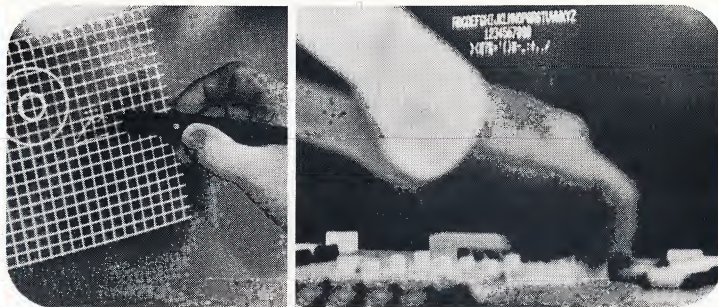
character strobe pulse (negative transition)

Speed	500 kHz stroke writing rate
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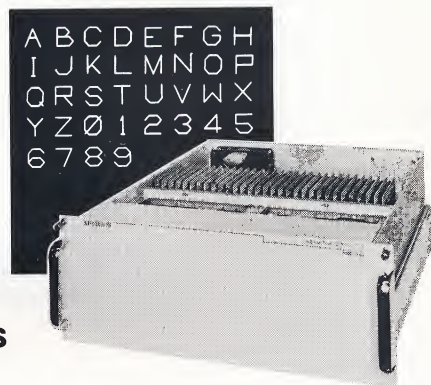
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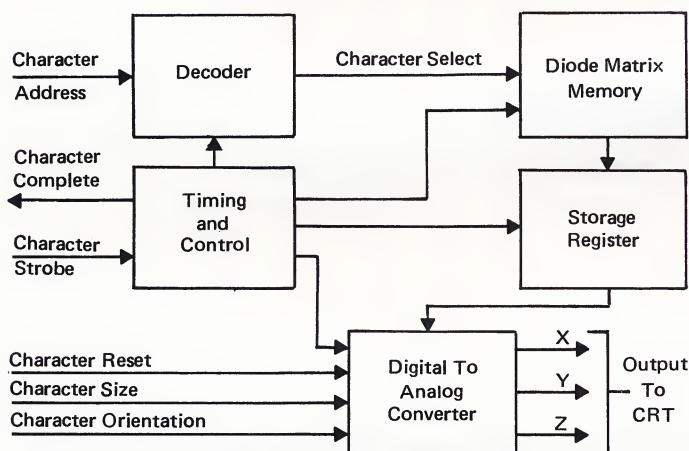
8040 CHARACTER GENERATOR

For Direct Stroke Writing Graphic Systems



DESIGN FEATURES

- Up to 20 strokes per character
- Uniform intensity throughout character
- Maximum character writing time to 2 microseconds
- Asynchronous operation—write time is a function of the character being generated.
- 4—programmable character sizes
- Programmable character orientation—horizontal or vertical
- Repertoire of 64 alphanumeric characters and symbols
- Diode matrix memory easily reprogrammed to generate special characters (can be done by user).



FUNCTIONAL DESCRIPTION

The incoming CHARACTER ADDRESS consists of six binary lines that are decoded into 64 character select lines.

The CHARACTER STROBE triggers an internal clock that advances a shift register to produce a timing sequence of 20 discrete

pulses, each of which corresponds to a character stroke. As each timing segment is enabled through the shift register, a portion of the addressed character is examined to determine the X, Y and Z components of the stroke. The components specified by the diode memory are stored in a register. The storage register is strobed each clock time, which is synchronous with the segment, or stroke period. The outputs of the storage register are level shifted and integrated to produce the CRT deflection voltages and intensification signal.

At the end of a character cycle a CHARACTER COMPLETE signal is generated.

A CHARACTER ORIENTATION signal causes the displayed character to be rotated ninety degrees counterclockwise. Two character size signals are decoded to yield one of four possible character sizes.

The standard character repertoire is shown in Figure 1. This repertoire is equivalent to the 64-symbol ASCII set as defined in American National Standard publication USASX 3.4-1968.

FIGURE 1 — CHARACTER REPERTOIRE

A	B	C	D	E	F	G	H
I	J	K	L	M	N	O	P
Q	R	S	T	U	V	W	X
Y	Z	Ø	1	2	3	4	5
6	7	8	9	[	\	]	^
-	!	"	#	\$	%	&	'
(	)	*	+	,	.	/	
:	;	<	=	>	?	@	SP

↑ May be substituted for ^
← May be substituted for _

Other symbols are available on special request.

SPECIFICATIONS

All digital input and output signal levels and impedances are compatible with conventional TTL integrated-circuit logic.

Inputs

- (a) **Character Address:** 6-bit parallel word selects 1 of 64 characters. Lines are high when true. Lines must not change while character is being drawn.
- (b) **Character Reset:** Negative-going pulse used to reset digital-to-analog converter. Pulse width should be 100 nanoseconds minimum. Must precede the character strobe.
- (c) **Character Strobe:** Negative-going pulse used to synchronize internal clock. Generation starts on the first internal clock edge after the leading edge of strobe. Pulse width should be greater than one stroke period but less than 2 stroke periods.
- (d) **Character Orientation:** A high level on this line causes the character to be drawn in a horizontal orientation. This signal should not change during the time a character is being drawn. 100 nanoseconds are required for the orientation circuitry to settle to the new value.
- (e) **Character Size:** Two signal lines that are used to select 1 of 4 character sizes. Four microseconds are required for the size select circuitry to settle.

Outputs

- (a) **Character Complete:** Negative-going pulse 500 nanoseconds wide. Leading edge indicates that character is complete.
- (b) **Character Deflection Voltages:** ± 1.5 volts @ 20 mA (measured at the input to any display when terminated with 75 OHMS.)
- (c) **Character Intensification Voltage:** Digital signal TTL compatible, low during blanking, high during writing.

CHARACTER AND SYMBOL CHARACTERISTICS

- (a) **Number of Characters and Symbols:** 64. Standard set, per figure 1. Any other characters which are derivable using up to 20 strokes (including retrace) may be ordered optionally to replace any of the 64 standard characters.
- (b) **Type of Strokes:** 7 including $\pm X$, $\pm Y$, $\pm X/2$, Z .
- (c) **Writing Time:** Function of the character being generated and the model ordered.

MODEL	MAXIMUM	AVERAGE
8040-10	10 Microseconds	6.25 Microseconds
8040-8	8 Microseconds	5.0 Microseconds
8040-6	6 Microseconds	3.75 Microseconds
8040-4	4 Microseconds	2.5 Microseconds
8040-2	2 Microseconds	1.25 Microseconds

- (d) **Number of Strokes:** 20 Maximum
- (e) **Character Size:** Four programmed character sizes are available. Nominal character sizes are listed below:

SIZE	HEIGHT	WIDTH
1	1/8"	3/32"
2	3/16"	9/64"
3	1/4"	3/16"
4	3/8"	9/32"

- (f) **Aspect Ratio:** 4:3. Other ratios optional.
- (g) **Uniformity:** $\pm 5\%$ of character height.

POWER REQUIREMENT

- (a) **Input Power:** 115V $\pm 10\%$, 60 Hz $\pm 5\%$, 1A

MECHANICAL CONFIGURATION

- (a) **Size:** 19" relay rack drawer, 7" high, 20 1/2" deep.
- (b) **Weight:** 50 pounds.

ENVIRONMENT

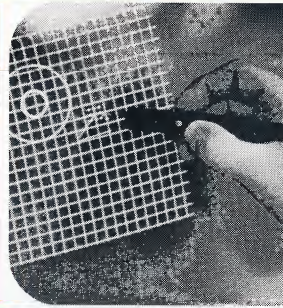
- (a) **Temperature:** 50°F to 100°F.
- (b) **Relative Humidity:** To 95% without condensation. Other ranges on special order.

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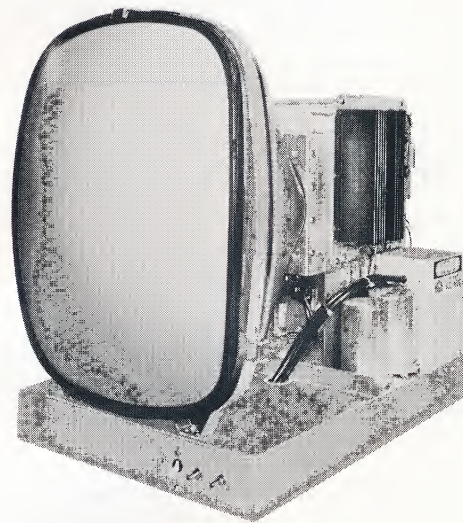
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MODEL 8011 CRT GRAPHICS MONITOR for COMPUTER GRAPHIC TERMINALS

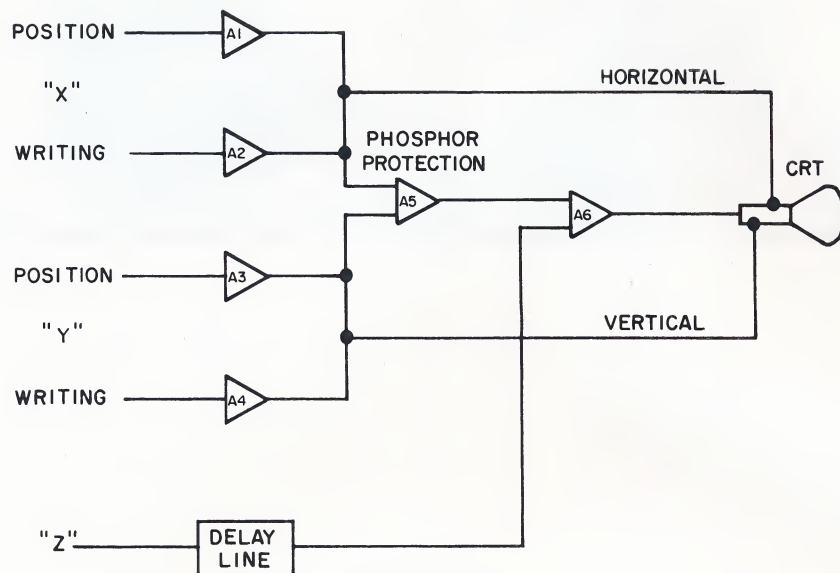


The MONITOR Model 8011 CRT GRAPHICS MONITOR is a direct-writing, alphanumeric/graphic computer output display. Characters, dots, vectors or conics may be displayed. Gamma correction and delay time cancellation are provided so that special circuits are not required in the appropriate generators. The tube is protected from phosphor burns as a result of failure in the

deflection circuitry or absence of input signal. Up to 1000 characters may be displayed at a refresh rate of 60 Hz; the writing rate for vectors and graphics is 500,000 inches/second. A complete line of character, vector, circle, ellipse and arc generators is available from MONITOR to work with this unit.

DESIGN FEATURES

- SINGLE MAGNETIC COIL DEFLECTION
- ALL SILICON SOLID STATE CIRCUITRY
- LARGE DISPLAY AREA (12" x 12")
- ZERO DIFFERENTIAL DELAY INTERFACE FOR FAITHFUL REPRODUCTION OF CHARACTERS, VECTORS, AND CONICS.
- BONDED FACEPLATE
- GAMMA CORRECTION
- PHOSPHOR PROTECTION
- PINCUSHION CORRECTION
- LOW POWER CONSUMPTION



A1 through A4 are wideband amplifiers used for positioning and writing. All amplifiers are dc coupled and have 75-ohm inputs. Self-contained adjustments are available to set up each channel. A5 is the phosphor protection amplifier whose output inhibits the z-axis amplifier, A6, should there be no deflection signal at the outputs of A1 – A4. A6 is the z-axis amplifier with gamma correction which is dc coupled and accepts an analog signal. A delay line is added in series with the input to match the delay of the x and y amplifiers.

SPECIFICATIONS

CATHODE-RAY TUBE

SIZE AND TYPE	21" with P31 phosphor and bonded faceplate.
DISPLAY AREA	12" x 12"
LINEARITY	±1%
PINCUSHIONING	±2%
LIGHT OUTPUT	50 foot-lamberts
WRITING SPEED	500,000 inches/second
SPOT SIZE	0.020"

Z-AXIS

INPUT SENSITIVITY	+3 v for full intensity
INPUT IMPEDANCE	75-ohm termination is standard.
RISE TIME	50 nsec
GAMMA CORRECTION	Light output is linear with respect to input voltage
DELAY TIME	Zero differential delay of the z-axis with respect to the X and Y signals.

MAJOR DEFLECTION

INPUT SENSITIVITY	5 v p-p for 12" deflection.
INPUT IMPEDANCE	75-ohm termination is standard.
LARGE SIGNAL RESPONSE	20 kHz.
SMALL SIGNAL RESPONSE	500 kHz @ -3db.
X-Y PHASE SHIFT	Less than 1 line separation @ 15 kHz.
SETTLING TIME	14 microseconds for full deflection within 12" x 12" viewing area to settle within 0.25% 3 microseconds for 0.5" deflection to settle within 0.25%

MINOR DEFLECTION

INPUT SENSITIVITY	5 v p-p for 0.5 inch deflection.
INPUT IMPEDANCE	75-ohm termination is standard
FREQUENCY RESPONSE	1 MHz @ -3db.
X-Y DIFFERENTIAL PHASE SHIFT	Less than 1 line separation @ 1 MHz.

INPUTS: (BNC Connectors, rear)

1. X-input Major Deflection
2. X-input Minor Deflection
3. Y-input Major Deflection
4. Y-input Minor Deflection
5. Z-input

OPERATOR CONTROLS: (Front)

- On/off
- Focus
- Intensity

SERVICE ADJUSTMENTS: (Rear):

- X-input deflection sensitivity
- X-input D.C. level
- Y-input deflection sensitivity
- Y-input D.C. level
- Z-axis D.C. level

POWER REQUIREMENTS	115 v ± 10%, 60 Hz, 300 watts
ENVIRONMENT	50° F to 100° F.
SIZE	24½" H x 19" W x 27½" D.

OPTIONS:

- RACK MOUNTABLE Includes Parts for mounting in 19" relay rack.
- COVER HOOD 20½" H x 24" W x 33" D. CRT Horizontal.
- OTHER OPTIONS
 - Higher performance
 - Custom configurations
 - Daisy chain operation.
 - Ruggedized units.
 - MIL or NASA Specifications

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MONITOR 8041 CHARACTER GENERATOR for High-Performance CRT Displays

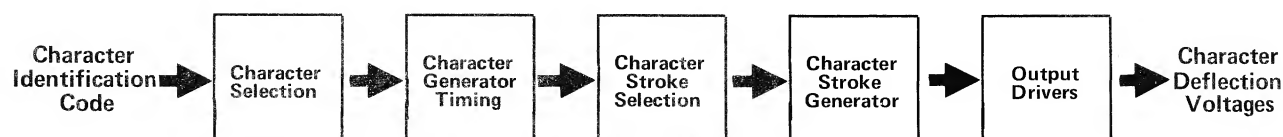
The MONITOR Model 8041 Character Generator provides high-speed digitally controlled stroke character generation for use with direct-writing cathode ray tube display systems. This Character Generator produces 20-stroke characters in 10 microseconds maximum, offering high performance for graphic display systems.

DESIGN FEATURES

- Up to 20 strokes per character
- Maximum character writing time: 10 microseconds
- Average character writing time: 6.25 microseconds
- Repertoire of 64 alphanumeric characters and symbols.

FUNCTIONAL DESCRIPTION

The input lines accept the character identification information upon which the generator operates to provide the proper character deflection signals. The block diagram shows the inter-relationship of the various functional elements.



CHARACTER GENERATOR

The receipt of a write-start signal enables a character clock gate thereby permitting clocked generation of the signals required to generate the character. This timing provides up to 20 sequential signals for the generation of the character strokes. A character is formed automatically by generating a vector stroke signal in each of up to 20 intervals. The standard character repertoire is shown in figure 1.

Each individual stroke is a vector sum of one or more units in the plus or minus X, plus or minus Y or one-half unit in the plus or minus X directions.

The character stroke functions are selected by sequencing an MOS read only memory. The sequencing is accomplished under character generator timing control. The appropriate sequence is selected by decoding the 6-bit character address input lines.

The output of the ROM is strobed to the function generators and an intensity modulator which turns the beam off during retrace or background motions.

Function generators provide accurate voltage levels which are summed and integrated by output driver circuits. These outputs are the complex X and Y deflection voltages necessary for the stroke generation of characters.

A write-complete pulse is provided for asynchronous operation.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Q	R	S	T	U	V	W	X	Y	Z	ø	1	2	3	4	5 6
7	8	9	[	\	]	^	—	!	"	#	\$	%	&	'	
(	)	*	+	,	-	.	/	:	;	<	=	>	?	@	(space)

Figure 1 — Character Repertoire 64 Upper Case ASCII Set

ELECTRICAL SPECIFICATIONS

All digital input and output signal levels and impedances are compatible with conventional TTL integrated-circuit logic.

INPUTS

Character Selection 6-bit parallel words

Control Pulses Write Start

OUTPUTS

Control Pulses Write Complete

Character Deflection Voltages ± 1.5 volts @ 20 ma. (measured at the input of any display when terminated with 75 ohms).

Character Intensification Voltage..... Digital signal, low during blanking, high during write.

CHARACTER & SYMBOL CHARACTERISTICS

Number of Characters and Symbols 64, upper case ASCII. Standard set per figure 1.

Writing Time 10 microseconds maximum.

Average Character and Symbol

Writing Time Approximately 6 microseconds.

Number of Strokes..... 20 maximum.

Aspect Ratio 4 units high by 3 units wide.

Uniformity..... $\pm 5\%$ of character height.

POWER REQUIREMENTS 115 volts $\pm 60\text{Hz}$ ± 3 cycles, 0.5 ampere.

MECHANICAL CONFIGURATION 19" wide x 1 $\frac{3}{4}$ " high x 5" deep

ENVIRONMENT

Ambient Temperature 50° to 100° F

Relative Humidity to 95% without condensation

OPTIONS

Horizontal or vertical orientation of characters

Four character sizes

Provisions to generate special characters

Higher speed character generation